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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 300560WO/DJW/DG	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/IB2002/003198	International filing date (day/month/year) 21.06.2002	Priority date (day/month/year)
International Patent Classification (IPC) or national classification and IPC H04Q 7/38, G01S 5/14 // G01S 5/00		
Applicant Nokia Corporation et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 3 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ (sent to the applicant and to the International Bureau) a total of 6 sheets, as follows:

☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

<input checked="" type="checkbox"/>	Box No. I	Basis of the report
<input type="checkbox"/>	Box No. II	Priority
<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
<input type="checkbox"/>	Box No. IV	Lack of unity of invention
<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
<input type="checkbox"/>	Box No. VI	Certain documents cited
<input type="checkbox"/>	Box No. VII	Certain defects in the international application
<input type="checkbox"/>	Box No. VIII	Certain observations on the international application

Date of submission of the demand 21.01.2004	Date of completion of this report 22.09.2004
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Åsa Rydenius/BS Telephone No. +46 8 782 25 00

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International Application No.

PCT/IB2002/003198

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

- ☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-22 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 23-28 received by this Authority on 25-06-2004

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-3 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (specify): _____

☐ any table(s) related to the sequence listing (specify): _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing (specify): _____

☐ any table(s) related to the sequence listing (specify): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International Application No.

PCT/IB2002/003198

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims	<u>1-34</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-34</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-34</u>	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1: WO0199444 A1

D2: US6415155 B1

D3: WO0217669 A1

D4: US5260943 A

D5: "Experimental performance of methods to estimate the location of legacy handsets in GSM" (Spirito et al, 2001)

The cited documents represent the general state of the art. The invention defined in claims 1-34 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed method and network device for determining the path of a signal between a donor network element and a remote station. Therefore, the claimed invention is not obvious to a person skilled in the art.

Accordingly, the invention defined in claims 1-34 is novel and is considered to involve an inventive step. The invention is industrially applicable.

Claims

1. A method of determining the path of a signal between a donor network element (14) and a remote station (20), the donor network element (14) being associated with at least one repeater (16, 18), comprising the steps of: receiving at the remote station (20) a plurality of signals associated with a plurality of network elements (10, 12, 14); calculating an estimate of the distance between the remote station (20) and each network element (10, 12, 14), including an estimate of the distance between the remote station (20) and each repeater (16, 18) associated with the donor network element (14); determining the one of said estimates of the distance between the donor network element (14) and at least one associated repeater (16, 18) and remote station (20) which most closely approximates to the distance between the other network elements (10, 12) and the remote station (20); and selecting that donor network element/repeater to be the source of the signal.

2. A method according to claim 1, wherein the step of calculating an estimate of the distance between the remote station (20) and each network element (10, 12, 14) comprises: selecting each one of the donor network elements (14) and at least one repeater (16, 18) in turn as the source of the signal; and performing said calculating step for only the selected one of the donor network element (14) and at least one repeater (16, 18).

3. A method according to claim 1 or claim 2 wherein the step of calculating the estimate of the distance includes estimating the location of the remote station (20) and thereby estimating an actual distance between each donor network element/repeater and the remote station (20).

4. A method according to claim 3 wherein the step of calculating the estimate of the distance includes measuring physical quantities at the remote station (20), and thereby estimating a model distance between each network
5 element/repeater and the remote station (20).

5. A method according to claim 4 wherein the measured physical quantity includes the measurement, at the remote station (20), of one or all of: a time delay in a received signal; attenuation in a received signal or received signal
10 strength.

6. A method according to claim 5 wherein the step of estimating the actual distances further comprises summing the estimated actual distances.

7. A method according to claim 6 wherein the step of
15 estimating the model distances further comprises summing the model distances.

8. A method according to claim 7 further including calculating a scale factor in dependence on the summed actual and model distances.

20 9. A method according to claim 8 wherein the scale factor is determined to adapt the scaled sums to be equal.

10. A method according to claim 9 wherein the scale factor is determined by dividing the summed actual estimates by the summed model estimates.

25 11. A method according to claim 9 or claim 10 wherein the model distances estimates are modified in dependence on said scale factor to produce a set of modified model distances.

12. A method according to claim 11 wherein the model distances are scaled by the scaling factor to produce the modified model distances.

13. A method according to claim 12 further including
5 calculating a difference value for each donor network element (14) and at least one repeater (16, 18) by summing the difference between each estimate and each modified model estimate obtained for each respective donor network element (14) and at least one repeater (16, 18).

10 14. A method according to claim 13 wherein, the signal is determined to be transmitted from the donor network element (14) or at least one repeater (16, 18) having the lowest difference value.

15 15. A method according to any one of claims 1 to 14 wherein a plurality of signals are from a donor network element (14), wherein all steps are repeated for each such signal to determine a source of each signal.

20 16. A method according to any preceding claim, further comprising the step of calculating the location of the remote station (20) in dependence on the determined source of the signal.

17. A method according to any preceding claim wherein the remote station (20) is a mobile station and the donor network element (14) is a donor base station.

25 18. A network device (20) adapted to determine the path of a signal between a donor network element (14) and a remote station (20), the donor network element (14) being associated with at least one repeater (16, 18), comprising means for calculating an estimate of the distance between

the remote station (20) and each network element (10, 12, 14), including an estimate of the distance between the remote station (20) and each repeater (16, 18) associated with the donor network element (14), based on a plurality of
5 signals received at a mobile station (20); means for determining the one of said estimates of the distance between the donor network element (14) and at least one associated repeater (16, 18) and remote station (20) which most closely approximates to the distance between the other
10 network elements (10, 12) and the remote station (20); and means for selecting that donor network element/repeater to be the source of the signal.

19. A network device (200) according to claim 18, wherein the remote station (20) is a mobile station and the
15 network element (10, 12, 14) is a base station.

20. A network device (200) according to claim 18 or claim 19 wherein the means for calculating an estimate of the distance between the remote station (20) and each network element (10, 12, 14) includes: means for selecting
20 each one of the donor network elements (14) and at least one repeater (16, 18) in turn as the source of the signal; and means for performing said calculating step for only the selected one of the donor network element (14) and at least one repeater (16, 18).

21. A network device (200) according to any one of claims 18 to 20 wherein the means for calculating the estimate of the distance includes means for estimating the location of the remote station (20) and thereby estimating an actual distance between each donor network
25 element/repeater and the remote station (20).
30

22. A network device (200) according to claim 21 wherein the means for calculating the estimate of the distance includes means for measuring physical quantities at the remote station (20), and thereby estimating a model
15 distance between each network element/repeater and the remote station (20).

23. A network device (200) according to claim 22 wherein the measured physical quantity includes the measurement, at the remote station (20), of one or all of: a
10 time delay in a received signal; attenuation in a received signal or received signal strength.

24. A network device (200) according to claim 23 wherein the means for estimating the actual distances further comprises means for summing the estimated actual
15 distances.

25. A network device (200) according to claim 24 wherein the means for estimating the model distances further comprise means for summing the model distances.

26. A network device (200) according to claim 25
20 further including means for calculating a scale factor in dependence on the summed actual and model distances.

27. A network device (200) according to claim 26 wherein the means for calculating the scale factor is adapted to convert the scaled sums to be equal.

25 28. A network element (200) according to claim 27 wherein the scale factor is determined by dividing the summed actual estimates by the summed model estimates.

29. A network device (200) according to claim 27 or claim 28 wherein the model distances estimates are modified

in dependence on said scale factor to produce a set of modified model distances.

30. A network device (200) according to claim 29 wherein the model distances are scaled by the scaling factor
5 to produce the modified model distances.

31. A network device (200) according to claim 30 further including means for calculating a difference value for each donor network element (14) and at least one repeater (16, 18), including a summer for summing the
10 difference between each estimate and each modified model estimate obtained for each respective donor network element (14) and at least one repeater (16, 18).

32. A network device (200) according to claim 31 wherein the signal is determined to be transmitted from the
15 donor network element (14) or at least one repeater (16, 18) having the lowest difference value.

33. A network device (200) according to any one of claims 18 to 32 wherein a plurality of signals are received from a donor network element (14), wherein all steps are
20 repeated for each such signal to determine a source of each signal.

34. A network device (200) according to any one of claims 18 to 33, further comprising means for calculating the location of the remote station (20) in dependence on the
25 determined source of the signal.